

THE MOTOR AGE

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THE CRUCIAL YEAR 1900

DESIGNS OF MOTOR VEHICLES SO FAR LARGELY BORROWED FROM EUROPE.—FULL DEVELOPMENT OF A SUITABLE AND PERMANENT AMERICAN TYPE TO BE EXPECTED OF THE COMING YEAR.

If it were only approximately true that the construction which has been followed in the past in Europe would form the foundation of what will be done in the future in United States in order to produce motor vehicles perfectly adapted for American conditions in general and American roads in particular, repeated explanations of the mechanical elements in existing types of motor vehicles would

be of great practical importance, but all probabilities point in the opposite direction. The steering gears of today will be antiquated as soon as driving from the rear axle shall have been abandoned, which it probably will be for all vehicles intended to travel over all kinds of roads; and rear steering will hardly be adapted for front-driven vehicles. The gasoline motors which are used on the most suc-

cessful vehicles of today are already left far in the distance by motor constructions which have not yet been fully tried in connection with vehicles but which promise much better result than so far obtained and which especially promise radical simplification of running gears. Every indication points to the year 1900 as the crucial year when the real mechanical foundation for automobilism in the next century will be laid. Then details of construction accepted in 1898 or 1899 will be of only historical interest, of importance to the student of motor vehicle evolution, but of small consequence to the public, who look for results and have no time for studying those features whose destiny it is to be superseded in a near future.

The Public Interest in Suspense.

If a parallel be drawn between motor vehicles and bicycles it might be said that the former are still comparable to the old Ordinary, excellent in their way, fine instruments for sport and frequently as much preferable to horse traction for utility as the Ordinary was preferable to walking. But they are not the Safety, as yet. The center of gravity in their evolution lies still ahead of us, and this may be readily realized when the actual motor vehicles of today are compared with the requirements of every vehicle user. There is some fundamental feature of construction which is necessary to make motor

vehicles broadly acceptable and which is still unrecognized. Inventions and manufacture are all tending slowly but irresistibly toward its realization, groping for the objective point through the gradual elimination of errors; and some day, which seems to be near at hand, it will flash upon some mind of more than common grasp of intuition, may, then, be embodied in a vehicle and will be instantly recognized as the needful thing—though grudgingly accepted. And from that moment the broad public will demand to know all details of construction. But that moment is not yet. At present the public want results, and only if the results that can be demonstrated are sufficiently favorable for the vehicle purposes which they, severally, have in view will they consent to study mechanics. Those who study motor vehicle mechanics today are therefore either professionally connected with the industry or their interest centers in the sporting element of automobilism. But this element is weak in comparison with the enormous importance of the perfected motor vehicle for civilization in general. The Motor Age stands on the broader basis and aims to record the data of progress in automobilism in their due proportions to their significance for the human race in general, to whom the sport of automobilism is devoid of interest if it disregards the utility requirements which eventually must prevail.

SLOW SPEED MOTOR VEHICLES

THE PROBLEM THAT CONFRONTS BUILDERS OF GASOLINE MOTOR VEHICLES MOST EASILY SOLVED WHEN THE SPEED RANGE OF THIS TYPE IS REDUCED TO CONFORM WITH UTILITY PURPOSES AND CONDITIONS OF AMERICAN ROADS.

Our light steam vehicles, against which the main indictment is that they require a man with good engineering ability to run them well and take proper care of them, have beaten the French gasoline vehicle on all essential points. The skill required for operating them may be acquired, by a well-educated person without

special training as engineer, in the same time that a French chauffeur requires for becoming proficient. In the case of the steam vehicle the skill pertains principally to the care of the engine; in that of the French gasoline vehicle to the operation of the running gear. The honors are about even in this respect, but

the steam vehicle is superior in point of control, equal in speed and weight and probably far superior in durability under good management, as the wear on the engine portion decreases with low speed while wear and tear on French gasoline motors, with their almost constant motor speed are undoubtedly highest when the vehicle goes slowly on level ground and does not utilize the full power developed.

To Excel Over Steam Wagons.

The American gasoline motor vehicle builders have the problem before them to beat the steam vehicles which have beaten the best French gasoline vehicles, and it is readily seen that this must be done by excelling the steam vehicle where it is weak—the skill required—and equaling it where it is strong—control and freedom from noise and vibration at the low speeds.

This problem is not very difficult to solve for vehicles of which high speed will under no circumstances be required. And the field of building slow speed gasoline motor vehicles for utility purposes is therefore very attractive. But to solve it for wagons which must also be capable of high speeds, or in other words to combine a great range of speeds in the same vehicle without serious troubles at one or both ends of the scale, will probably require gasoline motors largely different from any of those that have gained a reputation in the French industry.

Already On the Right Road.

To prevent misunderstanding it may, however, be well to admit that several American gasoline motor vehicles of the

present day already show great progress over French prototypes in simplicity of handling. They require less technical skill than either the American steam wagon or the French gasoline wagon. Their shortcomings are in the lessened reliability of the motor which has naturally followed the laudable attempts to so remodel this motor that its power would be more flexible and better adapted to all degrees of speed and load.

Within reasonable limits of speed and work these existing types of gasoline motor vehicles even now give much better results than horse traction, and most troubles arise from the fact that manufacturers cannot resist the temptation to design gears and motors chiefly with a view to speeds from 10 miles per hour up—a field which the Frenchmen with their good roads should have to themselves—instead of for the much more important speeds from 10 miles per hour down. When the choice is once made by the designer he will find it fully as easy to make a reliable low speed gasoline vehicle, as the French have found it to make a reliable high speed vehicle. The difficulty lies at present in covering a wide range of speeds.

Endurance Contests Desirable.

In a long distance race over ordinary roads with plenty of hills it would be interesting to enter gasoline vehicles built specially for speeds not exceeding fifteen miles against others geared to higher maximum speeds, and note the results, proviso being made that no repairs be allowed beyond mere care taking.

PRODUCTIONS OF BENZ COMPANY

MODERN VEHICLES DESIGNED BY THE ORIGINAL INVENTOR OF GASOLINE MOTOR VEHICLES.

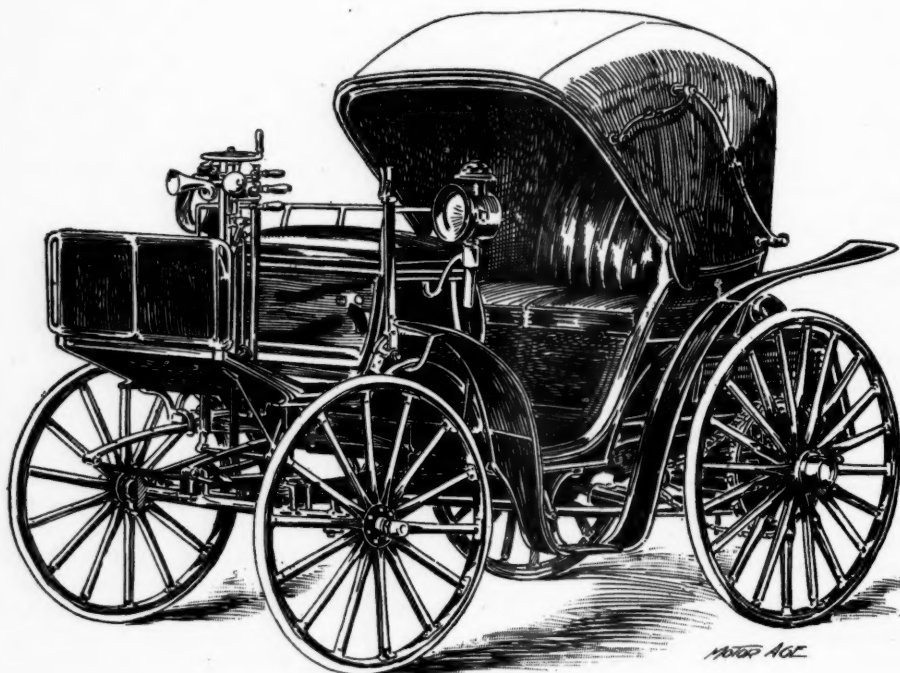
The German motor vehicle industry is dominated by two firms, the Daimler Motor Company of Caunstatt and Benz & Company of Mannheim, both pioneers in motor construction and parent concerns for large vehicle manufacturing establishments in France and England, in which

the mechanical foundation consists in the Daimler and Benz motor patents, which date back to 1885 and 1886. The first Daimler patent was obtained August 29, 1885 and referred to a gasoline motor applied to a velocipede. During the same year Carl Benz had built the first modern

gasolene motor vehicle which had three wheels and room for two persons. The motor was of about $1\frac{1}{2}$ to 2 H. P. and the patent for the construction used in this vehicle was dated January 29, 1886.

In course of time this original Benz vehicle has been much improved, though its development into practical types has been slower than that of the Daimler motor, which was taken in hand by Levassor

on the front cover of this issue. It is named the Benz "Mylord," is fitted with an 8 H. P. motor, and has room for five persons, one seat being for a servant. This was exhibited at the recent International Motor Vehicle Exhibition in Berlin together with three styles of Benz "Velo-Komfortables," which belong in the "voiturette" class. One of these won the first prize in the long-distance race held in



THE BENZ COMPANY'S "MYLORD."

of Paris and developed into the powerful and reliable Daimler-Phoenix motor used on the Panhard-Levassor vehicles, whose victories at all long distance races in France are fresh in the memory of Motor Age readers.

Prizes at Berlin Exhibition.

It is one of the Benz Company's latest styles which is illustrated herewith and

connection with the exposition, and another took second money. Another Benz model is the 5 H. P. "Duc," which has room for three. It was tried at the German military manoeuvres and was highly spoken of by the military authorities. It is especially built for physician's work, however. An "American Phaeton" with room for five is another of the company's latest creations.

ROOTS' KEROSENE MOTOR VEHICLE

WELL-KNOWN WRITER AND EXPERIMENTER WITH GASOLENE MOTORS PLACES CARRIAGE FITTED WITH KEROSENE MOTOR ON ENGLISH MARKET.

The name of J. D. Roots is well known wherever gasolene motors are used as one of the earliest investigators of this type of engines and is recognized not only as an able and prolific writer on the subject but also as one of those rare students who, while deeply engrossed in their specialty, never lose sight of imperfections attaching to it, but are spurred on by these imperfections to devise suitable and, if needs be, radical remedies for the same. These characteristics of the man render his personal work worthy of general attention even from afar.

Mr. Roots is one of the firm of Roots & Venables of London and this house has just placed its R. & V. Petro-Car on the English market, having the metal parts manufactured, after Mr. Roots' designs, by the Birmingham Small Arms Company.

In this car common kerosene is used for producing the explosive mixture.

Description of Motor.

The motor construction is described as follows:

The vehicle is a single seated four-wheeler mounted on suspension wheels fitted with solid rubber tires. The engine is placed behind the rider's seat, and is of the horizontal type, with crank-shaft towards the front of the car.

It is of 3-indicator horse-power, with a single cylinder, and embodies the well-known Roots' patents for oil engines. The kerosene is drawn into the vaporiser from a grooved spindle, by means of a volume of air previously superheated by passing around the ignition tube casing, which is an annular chamber and forms the vaporiser. The mixed charge passes around the interior of the vaporiser into the cylinder, where it is again mixed with a further supply of cold air, drawn through an automatic valve in the wall of the explosion chamber, and forms the explosive charge, ready to be compressed by the return stroke of the piston, and fired. The charge is fired after compression by an incandescent ignition tube. This tube is heated on first starting the engine, by a detachable blow lamp using petroleum oil. This lamp not only heats up the tube, but raises the temperature of the vaporiser to its working point. After the en-

gine is started this lamp is removed, there being no further use for it, and the ignition tube is kept hot by means of a blow lamp using oil from the ordinary oil supply. The blast for this permanent oil lamp is obtained by the reciprocation of the piston within the cylinder and is led from the forward crank chamber into a separate chamber at the side, where, after passing through an air-cushion chamber, it travels with a regular, not a pulsating, draught, to the burner, picking up its proper proportion of oil on the way.

The hot exhaust for the engine is also used to superheat the charge, and then passes underneath the car to a silencer. The exhaust valve is operated from a two-to-one shaft parallel with the engine shaft and placed across and above the cylinder, and which is geared to the cylinder by a chain and chain wheels. This shaft, besides carrying the exhaust valve cam, also carries the governor, and, in addition, takes the actual driving of the car when on the low series of speeds.

Governor's Double Function.

The governor not only cuts out the charge when running at too high a speed, but also regulates the quantity of oil used to exactly suit the work being performed.

The air drawn in for the charge by the outward stroke of the piston, after being superheated, passes through a chamber crossed by a sliding spindle. This sliding spindle has cut upon it several circumferential grooves, which, when the spindle reciprocates in its well fitting bore, alternately enter the chamber, passed through by the ingoing air and another chamber in connection with the oil supply. By this means the oil is carried at the right moment, and contained in the grooves, into the chamber through which the hot air is rushing on its way to the cylinder. The oil is swept off by the rush of air, with which it immediately mixes in the form of a gas and travels along through the second superheating chamber to the cylinder as already described. It is upon this grooved spindle that the governor operates, by regulating the length of its travel. When the load is light and the engine consequently has a tendency to increase speed, the governor prevents the grooved spindle from entering too far into the air passage and thus regulates the charge by decreasing the number of grooves swept by the blast, and hence the quantity of oil swept off, while, if the load is still further decreased, it may cut out one charge completely, by allowing no groove to enter the air passage, thus allowing no oil to be swept off.

The cylinder is water jacketed, and is kept

cool by a positive water circulation. The water for cooling purposes is stored in two tanks, one on each side of the engine, and which fit snugly along the inside of the wooden body. The water has a complete circuit through both tanks and around the cylinder, being connected up by copper tubes and circulated by an oscillating pump driven

by a rod from an eccentric on the valve shaft. The water circulation is passed through a coil of copper pipes encircling the rim of the engine fly wheel, which drives a strong current of cold air through the spaces between each coil of the tube, and forms one of the most efficient coolers ever fitted to a motor car.

FRONT-DRIVEN GERMAN ELECTRICS

PROMINENT GERMAN FIRM FINDS IMPORTANT ADVANTAGES IN FRONT STEERING AND DRIVING FOR ELECTRIC VEHICLES—TWO MOTORS ON FRONT AXLE.

Combined front steering and front driving forms one of the construction features in all electric vehicles turned out by the Actien-Gesellschaft Elektrizitaets-Werke, vormals O. L. Kummer & Co., in connection with the Stoll Wagon Works of Dresden, Germany. These concerns firmly assert that the king-bolt and fifth wheel steering arrangement employed in horse-drawn vehicles has proved itself so strong and reliable that motor vehicle makers can do nothing better than to apply it to motor vehicles as well; and this, of course, involves that the tractive force must be applied to the front axle, as otherwise the conditions would not be the same or at all comparable.

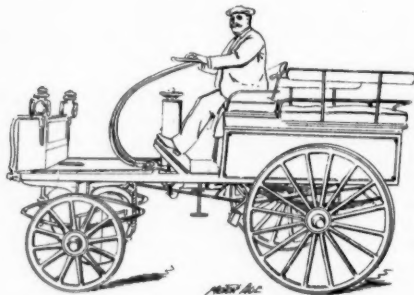
No Steering Gear Employed.

The steering lever is, therefore, by these firms, connected directly with the front axle and on the latter are mounted two motors, each driving one of the front wheels independently of the other. The description which has come to hand does not state whether the turning of the steering lever automatically regulates the current fed to each motor, but it seems that such is not the case and that the different speeds required of the two motors, when the vehicle's course is to be changed, is obtained solely through the different resistance to rotation which arises when the front axle is forcibly turned.

The accompanying illustration shows the outline of the company's so-called "American-Wagon," which is built on this principle and has seating capacity

for seven persons, and it will be noted that the load of passengers rests over the rear axle so as to make the steering method referred to so much more reliable while also reducing the manual effort of manipulating the steering lever.

It is stated that this driving principle permits as sudden turns, when the vehicle is on firm ground, as would otherwise be impossible with a four-wheeler though common enough for a bicycle. Only when the ground is soft so that the wheels sink in does the steering become



"American-Wagon," Front Driven and Steered.

hard work. But, says our authority correctly, that is not a practical objection as storage battery vehicles are, anyway, only adapted for use on paved streets.

Dished Wheels for Strength.

The wheels of these vehicles are dished although this design by placing the wheel axles oblique somewhat complicates the mounting of the motors. The object of dishing them is of course to increase their lateral strength.

The makers of these vehicles are also

producing mail and delivery wagons, all intended exclusively for use on paved streets, and all arranged so that the mo-

tor part may be easily detached from the rest of the vehicle and replaced in case of necessity.

WALTERS' MOTOR WHEEL

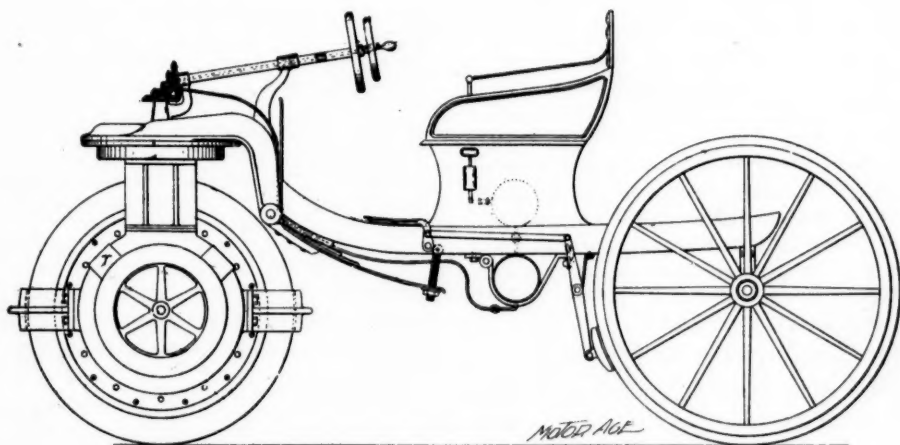
NEW YORK INVENTOR BRINGS OUT A ONE-WHEEL GASOLINE MOTOR TRACTOR TO BE HITCHED TO ANY FORM OF CARRIAGE.

Among the latest patents relating to motor vehicles No. 635,620, accorded to Julius M. Walters, of New York City, is of more than common interest, partly because the inventor has given his attention to the detachable-tractor problem, which represents one of the possible solutions of automobile difficulties which has been neglected in United States, and partly because two of the patent claims allowed

struction contemplated by the patentee and a side elevation of the tractor wheel, parts of the same being broken away.

As the invention hardly can be considered as final in all its details but chiefly notable as an indication of energetic work on a problem which has had little appreciation so far, a complete description of the mechanism is here omitted.

The two broadest claims are as follows:



WALTERS' MOTOR WHEEL APPLIED TO CARRIAGE.

are of greater breadth than usual in motor vehicle patents.

Reversing Gear Not Required.

Incidentally Mr. Walters shows how a reversal gear may be dispensed with when a tractor, or motor, wheel is used, by turning the entire motor wheel around on a vertical pivot and bringing the motor power to bear in the opposite direction.

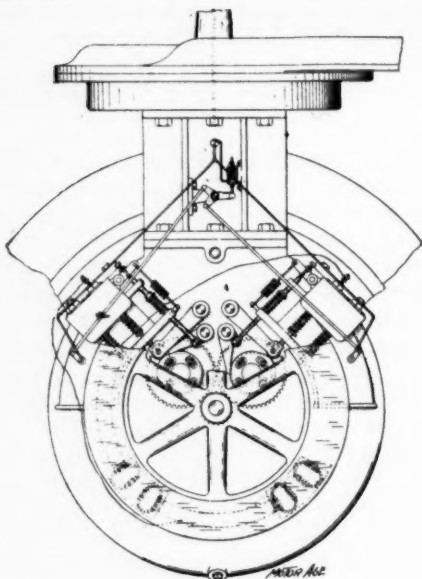
The illustrations show the vehicle con-

8. The combination with a vehicle, of a motor-wheel having its frame in hinged connection with the body or frame of the vehicle, a spring-cushion interposed between said motor-wheel and the body or frame of the vehicle, and means for starting, stopping and rotating said wheel attached to the hinged frame of said wheel, substantially as described.

12. The combination with a vehicle-wheel having a gas-motor thereon, of a generator of electricity actuated from the motor-shaft, an igniter for the motor, and electrical connections between said igniter and the gener-

ator; all such parts being adapted to travel in a parallel plane with the wheel, substantially as described.

The International Motor Wheel Company of New York City has been formed to exploit Mr. Walters' invention and exhibited at the National Carriage and



Side Elevation of Walters' Wheel.

Harness Makers' convention at Grand Central Palace New York one of these motor wheels weighing 350 lbs. attached to an ordinary delivery wagon which had been readily adapted to this form of traction.

AMERICAN VEHICLES IN GERMANY

Messrs. Beissbarth Brothers of Munich, Germany, write to The Motor Age to state that they are desirous of handling reliable American motor vehicles and have the facilities for doing an extensive business both wholesale and retail.

OMNIBUSES NOT OBTAINABLE

The Terminal Railway Association has decided to abandon for the present its intention of inaugurating a line of automobiles in St. Louis, and the prospects are that it will be some time before the horseless carriages will be in general use in this city.

President Julius Walsh, speaking of the

company's change of plans, said: "We will not attempt to operate an automobile line at present, as I have not been able to find a vehicle of the kind which just suits our requirements. We may inaugurate the line later on, but for the present we have given up the idea of placing automobiles on the streets of St. Louis."—St. Louis Republic.

MINOR MENTION

Mrs. Hetty Green, the richest woman in America, has bought an automobile and intends to use it in going about her business in New York, with her own hand on the lever and foot on the brake. She will thus save the expense of a driver and be, as she likes to be, perfectly independent. —Minneapolis Tribune.

The Safety Appliance and Development Co. has been organized at Kittery, Me., for the purpose of manufacturing and dealing in automobiles and other vehicles, with \$100,000 capital stock, of which nothing is paid in. The officers are: President, Robert A. Jordan of Boston; treasurer, Frank E. Rowell of Kittery.

Jacob Rech & Sons and Fulton & Walker, prominent wagon and carriage builders of Philadelphia, are constructing automobiles of the gasoline and steam-driven varieties.

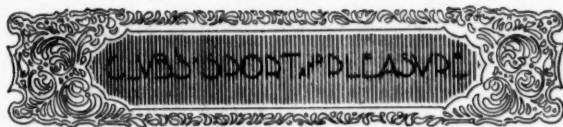
The National Carriage Builders' Association in convention in Indianapolis voted to exclude manufacturers of automobiles or automobile parts from membership.

Wm. Knabe & Co., piano manufacturers of Baltimore, contemplate to have motor wagons made for them wherewith to deliver pianos to their home city trade.

Maurice Walton and William E. Jackson, Jr., of Augusta, Ga., have secured the agency for Stanley steam vehicles for Georgia and South Carolina.

The stock of the Illinois Electric Vehicle & Transportation company, which has been quoted at $4\frac{1}{2}$ to 5, went down to $3\frac{1}{2}$ to 4 last week.

The machinery was set in motion this week at the factory of the Mobile Company now in course of erection at Tarrytown, N. Y.



GAINING GROUND IN BOSTON

BOSTONIAN BUSINESS MEN BEGIN TO TAKE AN INTELLIGENT INTEREST IN MOTOR VEHICLES AND THEIR CONSTRUCTION.—FIRST EXPERIENCE WITH ELECTRIC DELIVERY WAGONS ENCOURAGES OWNERS.—ORDERS SOLD AT PREMIUM.

Boston, Oct. 28.—This is now rapidly becoming a city of automobile users, compared with its former progress in the horseless line. Today, if a horseless carriage travels up Washington street, the people merely turn to look at it. Formerly they ran after it to see how it worked. Whenever one stops by the curbstone, it is at once surrounded, not, as one might expect, by a crowd that is simply curious, but composed of solid business men who ask intelligent questions of the driver.

The electric cab company, whose big stable on Tremont street is now practically finished, is largely responsible for this change in local locomotion. Boston is a peculiarly laid out town—for the benefit of those who have never been here—and driving an automobile through her streets has many difficulties not present in other cities. The streets are narrow and crooked in the business section and meet at all possible angles, yet the automobile has come to be a common sight. The electric cabs traverse all parts of the city and are serving daily to instruct the people in the new method of getting about.

Encouraged By Authorities.

The city has one Stanley wagon in use for city business. It is used by all sorts of city officials from the mayor down and has proved a great help, as well as a big saving in hack fares, which previously mounted scandalously. Mayor Quincy is a firm believer in the future of the horseless carriage and through his efforts another Stanley wagon will be added to the city's stable within a few days. The present carriage is used in paying the city employes in outlying districts who cannot readily come to city hall, and in this service it has frequently run 30 miles of an afternoon without taking on a fresh supply of fuel. The second carriage is to be

used in the same manner, carrying heads of departments to suburban districts and bringing them back.

R. H. White & Co., dry goods merchants, have three electric wagons in use for house deliveries and they have worked so cheaply that more are to be added as soon as obtainable. Cobb, Aldrich & Co., wholesale and retail grocers, have an electric van in daily use for hauling and deliveries to its various stores, as well as to houses. Their wagon is the largest in use in Boston at the present time.

The electric cab stable referred to is a model in its line. It is a remodeled building once used for the exhibition of mammoth paintings of the cyclorama order. Originally it was a circular shell, 120 feet in diameter and 60 feet from floor to eaves. For its new purpose, a second floor has been built, laid on iron beams. The floor is of brick, laid on cement. The cabs are stored on the second floor, which they reach by an inclined plane from the street through a separate passageway. In the lower room are the battery, dynamo and engine rooms. A large electric elevator carries the batteries for charging to the lower room and is of such capacity that one of the cabs may be lowered or hoisted if desired. The offices are in the front of the building in a newly built portion.

The public use of the cabs is increasing, in spite of an accident in which the driver napped and allowed the cab to turn turtle, throwing out a gentleman and lady. Since then, the drivers have been very careful.

Road Conditions Favorable.

The city has not yet reached the Philadelphian stage of development and automobiles are still excluded from its parks. Their use on the suburban roads, especi-

ally on Sundays, is much larger than last summer. The interest seems to be growing at a tremendous rate for conservative Boston. The city is more fortunate than many others in that it has what is known as the "sandpaper" district. Splendid macadam and gravel roads extend on all sides from 25 to 50 miles and the light runabout promises to be the style inside two years.

Tired of Waiting for Delivery.

The case of Warren T. Currier of Tremont Street is interesting. Mr. Currier placed an order last March with a Massachusetts builder for a carriage. As the summer drew to a close, with no appearance of a filled order, he sold his place in line for \$300. Then he ordered

three two-horse gasoline motors from St. Louis; had his wheels built by Eames of South Framingham, his running gear by a Boston metal worker under his own directions and expects to have his carriage running shortly. Anticipating, as do all rightly-minded persons, that the amateur is doomed to much experimenting, he has set up one of the motors in his basement, where he watches its working closely whenever a new problem confronts him.

The builders, however, are keeping very quiet. Great things are promised for the Victor steam wagon, but the Overman people are saying little until the time comes.

No new company has advertised stock for sale this week.

AUTOMOBILES ON TEXAS RANCH

FANCY SKETCH OF THE VICISSITUDES ENCOUNTERED IN APPLYING A GASOLINE MOTOR VEHICLE TO THE WORK OF THE BRONCHO AND VAQUERO.

An amusing story, drawn evidently from the lively imagination of Albert Henry Lewis, appears as a special correspondence from Texas in the Chicago Chronicle and has the merit of being no more improbable than many other automobile tales in which a pretension of truth-telling is more gravely maintained. The story runs as follows:

"I done busted bronks from Flagstaff to Red Rock and from the Big Horns to the river, but yere's w're I tossed my hand into the discard. I ain't got no call to play into no sech game. I reckon the old man's plumb locoed thataway. I reckon I better cash in and trail some'ers else. It's shore got me beat."

The foregoing remarks burst from the lips of "Buckskin" Carruthers, ranch boss for James Kennedy. Carruthers, as he has said, has had a deal of experience on the range roping cattle—whacking bulls, as the boys call it—and taming the wild cayuse. He is wont to remark that no "animal with four feet and shy a pair of horns" can buck him out of his saddle. He rather prefers a buckskin or mouse-col-

ored broncho, with a variety of spots on its side, sloping withers and rump and a parti-colored eye, commonly designated as a calico-colored cayuse. For, as he expresses it, he knows "the critter'll give him a good game and not lay down his hand till he's all cashed in." But, as said in the opening remarks, he has concluded that he has struck a game which has him skinned and he lays down his hand without drawing cards.

Kennedy is as much of a character in his way as "Buckskin." He is a grazer with a huge ranch out to the southwest a ways, has thousands of steers running over his range and miles on miles of barbed-wire fence to prevent their drifting out of control. He has recently been east, however, and being a "dead game sport," as the boys call it, has decided on an innovation. He is determined to round up his cattle spring and fall, look after the branding and cutting out with his cowboys mounted on automobiles instead of nervous, tricky and unconquerable ponies. He argues that one automobile is worth a whole string of the rascally

little brutes that must be "busted" over every time they are roped for saddle duty.

Cowboys Are Prejudiced.

This determination, backed up by an experiment along the lines laid down, is what provoked the outburst from the old vaquero. It came from the heart at that, for when a cowboy who has grown gray in the service passes up anything it is a pretty stiff proposition. Lack of experience with a particular kind of mount would never discourage a vaquero. If asked to do so he would undertake to round up a spring bunch, wild as hares and fleet as the fallow deer, astride of some long-horned veteran of the range. He would use a "bull" for a mount as quickly as a pony. But this automobile racket has him in a cold sweat if "Buckskin" can be quoted as an authority.

This Kennedy ranch lies out in the prairie lands, where hills are few and timber scarce. It is practically level outside of the "tanks" excavated by nature or provided by man, wherein the waters collect that the steers may not thirst. Like many another ranchero, since the breaking up of the big cattle associations and the cessation of the wire-fence wars of a decade or two ago, Kennedy has surrounded his two or three municipal townships with barbed-wire fences. Now, in scratching time, along in the spring, when the steers shed their coats, fences will be broken down.

In addition to this if a "blue-tailed norther" sweeps in off the gulf, the steers will "drift" before it. It bites fiercely and the unprotected brutes seek to escape by running before the wind for as many miles as may be necessary to outrun it. Now, a couple of thousand of cattle in such a progression will break down a fence much more stable than one of three strands of wire. Hence it is necessary to make an inspection of the fences every day to see no gaps permit the passage of unbranded cattle to the open range, where maverick rustlers can get them. Patrolling by pony with such an extent of fence means a number of men cut into gangs to meet at certain spots and compare notes.

Decides on an Experiment.

So Kennedy has decided to break in a

few automobiles of what is termed the runabout variety. These are good, strong roadsters, capable of doing good service in cross-country riding. The exact style of machine he expects to use is not yet constructed, but he has his plans and specifications in the hands of an eastern firm for building. But meanwhile he became eager to see how the thing would work, so he brought out one of the staple variety and having wound her up set forth to see what would come off. He found out.

When the thing—a gasoline machine, for he has no electric plant on his ranch—reached the ranch Kennedy amused himself and the boys by making it race around the corral and all about the house. Of course he let all the cattle out of the corral, for they threatened to stampede when the machine bore down on them. Then he broke in "Buckskin" to run the trap. He had his hands full for a couple of days, for the old cowboy did not take to the business very kindly, muttering things about the loco weed as he held his hat on with one hand and ran the lever with the other. But he learned enough to try the experiment.

"Now, Buckskin," said Kennedy, "you run this thing and make the rounds of them fences. Never mind the bulls today; we'll get at 'em later and rope away a few from the box. You guide the machine and three of the boys'll go with you. I'll camp on your trail with my hoss."

Buckskin's First Trial.

Well, the boys took their ropes with them, so as to be ready if they needed to rope a steer. "Buckskin" took his seat, saw that all was ready and then, to use his own expression, cut her wide open. The automobile struck out across the ranch as if hunting for the bridge over the Rio Grande. It was in a hurry, for the full power was on, and it is equal to about thirty miles an hour. It took the machine just six minutes to leave the owner and his nag so far behind that the men could not make out his dust. Then a halt was called, for "Buckskin" wanted some more orders. He had not found any breaks in the fence.

Well, Kennedy came up after awhile in a white rage. He yelled a few orders

about speed and "Buckskin" asked for instructions concerning how to regulate this. He got his information and a number of other words and the fun recommenced.

"I reckon you don't need to look for any more holes in them fences," said the boss. "See them calves over there? Well, git your ropes and we'll tackle some of 'em. Now, blame your hides, don't run away with that machine, for I want to use this hoss again."

"Buckskin" started the machine and then undertook to turn out from the fence. He had been traveling in practically a straight line up to this. Here is where he lost his first hand. He yanked the turning lever, but the wrong way. The machine, now under pretty good headway, switched suddenly into the fence, smashed all three wires and butted into a post. There it stuck, while "Buckskin" went over the dashboard across the only unbroken wire left. He had heavy leather leggings, which were badly torn, and he drove his nose into a clump of wild roses, so he was something disfigured when the boys took him out.

Rounding Up the Calves.

Fortunately the machine was not damaged and Kennedy backed it away from the post. Then he turned it out and headed it for the calves. When he had it at a safe distance from the fence he sent "Buckskin" back to the seat and told him to round up the calves. The machine bore down on the funny, hornless things. They and their dams took one fleeting squint at the trap, lifted their tails, lowered their heads, let out a frightened bleat or two and then stampeded for the presidio, some 500 miles away. The boys had out their ropes, but the ground is rough there and not a man could get a good swing.

"Durn your hide!" roared Kennedy, as he loped after the trap. "See that bunch? Let out a couple of cinches. Think this is a picnic? Let her go."

The machine jumped into the air like a thing of life. It settled to its stride and soon rattled right into the bunch. One of the boys cast a rope and "Buckskin" turned the machine short up, dropping his anchor off as he made the turn. The rope

settled about the neck of a short yearling, the machine stopped as if struck by lightning, the calf flew up into the air and the roper started on an independent journey to where the new moon peeped coyly from behind a white cloud in the blue heavens. He and the calf mixed it up at short range, for they came down in much the same spot. But the calf was as dead as a mackerel with a broken neck.

They investigated the calf first. Then Kennedy swore a few lines as he saw a good steer reduced to nothing. Then the boys thought it would be as well to look after the boy who threw the rope. They were fearful he had been hurt in the mix-up.

"Don't worry," said "Buckskin," as he rubbed a shin which had been scraped by the lever. "He's all right; he lit on his head."

It was true, he had fallen on his head, the one invulnerable spot in a cowboy's anatomy. He was wiping the blood from his nose and reaching about with the unoccupied hand for his rope. Then he got up, threw his hat violently on the ground, danced a few steps of the Omaha and asked if any gent present cared to shoot up with him. He was appeased after a time and the hunt was resumed, he sitting on the perch with "Buckskin."

Undermined by Prairie Dogs.

The machine was started again, but a new bunch must be sought, as the one being trailed had disappeared. As the ranch boss says, he is certain they are crossing the Rio Grande now. But cattle are plentiful and the boys soon ran down on a bunch of steers. Another throw was prepared for and off raced the machine. "Buckskin" steered beautiful this time. He followed the racing steers at express speed and the throw was about to be made when the trap ran into a prairie dog village. Instantly the fore wheels sank through the thin crust of earth, the driver and his chum sailed into the air and the two others plunged hastily forward, one knocking part of the cuticle from his cheek as he came in contact with the lever and the other falling under the front truck. He got out in orderly time.

"I'll ride this d—n critter or bust," growled "Buckskin" as he staggered to

his feet. "Either I'm locoed or the machine is. Yere I be, the best rider ever laid a leg over a saddle-flap, bucked off twice in an hour by a durn outomobble, or whatever in thunder the blame thing is. I figure they'll be a few happenings hereabouts and that durn soon."

The "old man" concluded about this time that it would be as well to postpone any further exercises until the team had some more practice, but to this "Buckskin" raised strenuous objection. He would play out the hand, win or lose, but he called for a showdown at least. No contrivance ever made by man could get the best of him. He had been bucked by a bicycle, but had won out, and he intended to beat the machine or lose a leg. So it was decided to make one more run.

Punctured at Last.

"Buckskin" headed the machine for the worst bit of land in the ranch. He wanted a quick decision. The ground is full of holes and hummocks in this part of the ranch and the cactus has its abiding place

there. But the angry ranch boss was determined to send the thing over the worst ground he could find and show that he could stick on to anything that could move. He yelled a defiance and bore down on a cactus bed.

Several resounding reports followed the plunge into the prickly pears. Gusts of wind rose from the wheels as the punctured tires gave up the ghost. The unwieldy vehicle gave a lurch, toppled to one side and settled suddenly into death. It stopped so soon that all four of the boys took flying headers into the cacti. Then there was groaning, swearing and rubbing of hands, for the hot spires entered the hard flesh and made life a hideous dream.

Thereupon "Buckskin" tossed his hand into the discard. The machine was knocked out, to be sure, but it had won every hand. The boss of that ranch swore he would resign if any more were brought there. But Kennedy is not satisfied, for he will try it again with a machine of his own devising.

LITTLE THINGS OVERLOOKED BY BEGINNERS

Most accidents with motor vehicles as well as most other troubles are due to the driver's failure to take proper care of the machinery, just as most troubles with horses may be traced to the stable attendants or the driver's recklessness or inexperience.

A gasoline motor vehicle that is well oiled and equipped with everything necessary to secure its proper operation, nearly always travels perfectly the first day. After the day's work is over the driver's first care should be to inspect the mechanism minutely and renew all supplies of gasoline, water and lubricants. But it is this caretaking that is always neglected, when things have gone well. The next day the derangement commences; the cylinders balk for lack of lubricants or cooling water; tubes become clogged and prevent water and oil from serving their purpose. Or perhaps it is the carburettor which is full of dust or the ignition tube

that fails to pass the spark and the explosions fail to materialize. Sometimes it is the driving axle which grips the bearings or a brake fails to perform its functions.

Then follows the whole gamut of mishaps until finally the vehicle refuses to budge and the driver is left out in a drenching rain or a scorching sun anathematizing the builder of the carriage. He can do nothing but to send to the nearest town for a machinist, or a horse to pull the vehicle to a shop while its occupants with bowed heads run the fire of taunting remarks of the populace. Arrived at some haven of refuge the would-be chauffeur now begins to investigate the cause of the balk and heroically goes to work to dismount the machine. He gets down on his back in the dirt and dust and gets his hands full of grease and finally discovers that the electric wire has been displaced.

The mere turning of a screw puts it

back in place. Or it is a belt which has been stretched through moisture and which must be tightened—little accidents that an experienced driver foresees and remedies in a few minutes. The new driver generally looks last where he should look first.

In regard to safety for life and limb the brakes and the steering apparatus are of the greatest importance. Faulty operation of these parts causes more serious accidents than any other defect in the mechanism or errors of the driver. In French machines there are at least two brakes of which one is operated by hand and takes effect on the rims or tires of the wheels. This is the least effective brake and suffers from the fault that it does not always press with the same force on the two wheels, so that coming down a hill and the other brakes failing, the result of applying the hand brake is frequently that the vehicle turns suddenly and is upset. This accident is especially frequent when the road is greasy after a rain. To block the wheels completely with the brakes when going down-hill at high speed is to invite death. An automobile should never be stopped suddenly but the brakes should be applied gradually, as a railway freight train is stopped by applying the brakes first on the rear cars and then progressively until the train is under control. Otherwise the remedy would be worse than the disease.—Chasseur Francais.

AUTOMOBILE PARADE IN NEW YORK

The Automobile Club of America of whose complete organization and membership an exhaustive account was given in last week's issue of this journal, informs *The Motor Age* through Secretary Capt. Homer W. Hedge, that it has arranged for the first club parade of automobiles to take place on Saturday, November 4, at 2 p. m.

The following details are given:

Seventy-five vehicles are expected to take part, representing all types of motors—steam, electric, gasoline and kerosene. The function will be a short distance run, not exceeding twenty miles, but the entire route will be over streets where the general public can view the pa-

rade. President Andrews in his victoria will head the line and Capt. Hedge will bring up the rear.

The parade will be formed in front of the Waldorf-Astoria on the south side of Thirty-third street, the head of the column resting on Fifth avenue. The route will be down Fifth avenue and around Madison Square, thence up Fifth avenue again to Mount Morris Park.

At One Hundred and Twentieth street the column will circle around the Park and continue on up Fifth avenue to One Hundred and Thirtieth street. Thence it will head across to Manhattan avenue to One Hundred and Tenth street and up Morningside Park to Columbia University, to Riverside Drive and on to Claremont.

At Claremont the club will serve a luncheon to the paraders. At 6 p. m. the line will form again and return by way of Riverside and the Boulevard to Fifty-ninth street and Fifth avenue.

Many prominent guests have been invited to ride on the various automobiles in the line. If the weather is favorable there will be a great turnout of wealth and fashion.

FORCES ENTRANCE TO CENTRAL PARK

New York, Oct. 28.—Winslow E. Buzby, a banker, and Whitney Lyon, two of the incorporators of the Automobile Club of America, attempted to drive a light automobile phaeton, propelled by electricity, into Central Park yesterday to test the right of the police or the Park Commissioners to exclude them. They were accompanied by counsel in another carriage.

They were bidden to stop at the Fifth avenue entrance of Central Park by Policeman John P. Keenan. They stopped and had a parley in which they said that under advice of counsel they believed that they could not be excluded from the Park. Keenan said that if they persisted he would arrest them. They then moved slowly into the Park and were told to drive to the Arsenal. Mr. Buzby was put under arrest on the charge of violating a park ordinance. The ordinance was not mentioned, and inquiry failed to show any other ordinance than one which provided that the Park could only be used by

pleasure carriages. Police Captain England said that he had received instructions verbally from the Park Commissioners to exclude automobiles. He said that the rules as to pleasure carriages applied because he did not consider an automobile a pleasure carriage under the rule. Mr. Buzby was held in \$100 bail for a hearing in the Yorkville police court. Mr. Lyon went on his bond and he was released.

The members of the Automobile Club urge that under the provisions of the charter the Park Commissioners cannot make rules for each park in the borough. When practicable, as in this case, any rule must apply to all parks. It is further contended that no rule has been made by the Park Commissioners which excludes automobiles, and that any such rule has to be made by a majority vote of the board under the charter. In fact, it is declared that Commissioners are acting under rules of the old board made in 1873 before automobiles developed.

AUTOMOBILE CLUB PROSPERING

New York, Oct. 25.—The Automobile Club is daily receiving new applications for membership and the list of charter members composed of the first one-hundred—who are exempt from the \$100 initiation fee stipulated in the by-laws—will soon be complete.

In addition to the list of charter members, or founders as they are called, mentioned in last week's letter, the following have been accepted: Edwin Gould, A. R. Shattuck, Frederick C. Stevens, George W. Young, O. F. Crosby, Albert C. Bostwick, John R. Hegeman, Jr., Joseph A. Blair, Gilbert W. Blanchard, Alfonzo E. Pelham, Col. Albert A. Pope and Walter E. Frew.

"We have already selected the site for our new club-house uptown, which will be built by a syndicate," says Secretary Hedge. "The plans are practically complete. The ground floor will contain the stables and repair shop. There will be room for the care and storage of all the automobiles of the members. There will be attendants and experts on hand at all hours to care for and repair the machines

of the members, and take them to their houses when needed."

CHICAGO'S DEAD ORDINANCE

The city authorities of Chicago are not enforcing an ordinance passed July 6 providing for examination and licensing of motor vehicle drivers.

The measure provided for a board of examiners to consist of the city electrician, the city engineer and the health commissioner. Vehicles are required to be fitted with alarm bells, and are not allowed to run over eight miles an hour. A brake has to be fitted which will stop the car within ten feet.

The reason assigned for the non-enforcement is that Mayor Harrison doubts the wisdom of the measure—or perhaps the competency of the examining board; for who shall examine the examiners?

RESTRICTIONS FOR STEAM VEHICLES

In connection with the parade in New York city projected for November 4 by the Automobile Club of America the question has been raised by the Police Board of that city whether steam vehicles shall be allowed in the streets unless conducted by licensed engineers.

The board has decided to classify all automobiles that are propelled by steam power as steam engines and rules that as such they will have to be inspected and each must have a regularly licensed engineer to run it.

The police has consequently been instructed to enforce the law when the parade comes off.

CLASSIFICATION FOR RACES

For motor cycle racing in the future motors will have to be classified by nationality and by horse power. There is far too great an opportunity in these machines to gain a temporary advantage through the increase of horse power in the motor. The one and one-quarter horse-power motor may never hope to compete against the one and three-quarter horse power, and the two and one-quarter horse-power motor has the advantage over them all. In the same way the French motor with the carburettor attachment, has a distinct advantage over the American made motors which are not fitted with this appliance. With all motors in a

contest of equal horse power and manufacture, the motor contest will be interesting.—New York World.

Would there not be precious little left to race about if all differences in con-

struction and manufacture were artificially strangled? It is not so easy as the World perhaps believes to fit a large motor to a tandem and get good results.

THE MOTOR AND PARTS TRADE

CONSTRUCTION OF VEHICLE SPRINGS

The Tuthill Spring Company, 315 Clinton street, Chicago, in which city the company has been doing business for twenty years, writes the following on springs for motor vehicles:

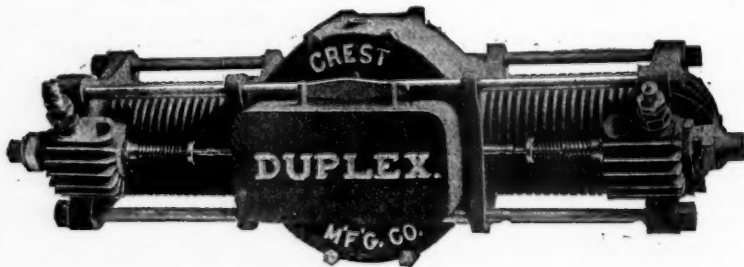
"The question of the suspension of automobile vehicles on springs may not be a difficult one to the mechanical engineer, but to the seller of the vehicle, whose customer judges of the materials used by the paint on the outside and the excellence of the motor power by the speed obtained, and who likes or dislikes the conveyance according as it is comfortable to ride in or the opposite, the matter of the springs is a very serious one. It is important that the springs used, whether platform springs or elliptic springs, should cause the carriage to ride with easy

tested by a brass center, which receives the wear of the bolt. But the rubber bushing alone is not enough to give a good spring. Excellence of material, skilled workmanship, judgment in designing and knowledge of how to make a good spring—all are needed."

THE CREST COMPANY'S PLAN

The Crest Mfg. Company, of Dorchester, Mass., writes in part as follows:

"We are placing on the market two types of motors, the single cylinder (simplex) and the double cylinder (duplex). We shall sell them at a reasonable price, and as they have been in use for a year and are in no sense an experiment we hope we can make an inducement to all cycle agents that own shops to make up a few tricycles or carriage



CREST DUPLEX GASOLENE MOTOR.

motion whether it has but one occupant or its full complement of passengers. Long experience in the construction of passenger vehicles for public highways has shown that the elliptic spring is best for ordinary passenger vehicles. The number of patented springs is legion, yet, while some, as the Brewsters and the Timkens, have had a remarkable popularity for a time, they have all been almost entirely abandoned in favor of the elliptic spring. To increase the softness of the elliptic spring a few years ago, rubber bushings were introduced into the head of the springs. This proved an advance in the art as is shown by the extension of the use of this elastic medium to the tires of the vehicle also. The rubber bushing is pro-

frames for their local trade. We will supply the motors and all data necessary to build frames of all kinds.

"We propose to furnish our customers with the data or drawings that we have obtained recently from France free in return for motors obtained from us.

"If the agent will follow out this plan with us he is sure to have a tricycle or carriage which will in no way be an experiment.

"The day of building bicycles in these small shops in the United States has gone by, and the cycle agent can now employ his tools and his time this winter and for the next few years to come in building automobiles for the local trade and should be able to build up considerable business."



FIRST PRINCIPLES OF STEERING

VARIOUS METHODS FOR CONTROLLING THE DIRECTION OF TRAVEL.—WHEEL VERSUS LEVER STEERING.—MEANS FOR PREVENTING VIBRATION OF STEERING MECHANISM.

For new periodicals on the motor vehicle subject the question always arises how much space shall be given over to explanation for the benefit of those whose interest in these things is new and whose knowledge is nil. The *Motor Car World* of London, whose first number has just appeared, takes the stand, apparently, that everything must be explained "from the ground up" and publishes several very readable articles on steering gears and gasolene motor mechanism. Being written in a clear and popular style, some extracts from these are given as follows:

Position of the Wheels.

When a vehicle is in the act of rounding a curve, it is imperative, in order to prevent side-slip, that the axes of all the wheels should radiate from one point; that is to say, assuming the axis of the rear wheels to be fixed, then prolongations of the axes of the two front wheels should intersect a prolongation of the axes of the rear wheels at one and the same point, and this should be the case to whatever extent the front wheels are turned.

As far as motive power is concerned, the loss from a slight error is not of any great moment at ordinary speeds, the most important inconvenience experienced being through the more rapid wear of the tires. At very high speeds, however, the necessity for greater accuracy becomes of far more consequence, and it would be desirable to carry it to such a pitch of perfection that it would be practicable to run a vehicle round in a restricted circle with as small an amount of resistance as if it were traveling in a direct line.

The Duryea Inclined Pivot.

The steering of the Duryea car is effected by means of an arrangement of great simplicity, which comprises a lever and two rods, the wheels being mounted upon the divided axle principle. The pivots of the wheels are placed at an inclination to the vertical, which position is found both to effect a considerably increased facility in steering, and furthermore to prevent the wheels from being suddenly jerked out of

their course through coming in contact with obstructions.

Bollee's System.

An arrangement for steering used by Bollee consists of two vertical sleeves arranged at the two extremities of the front cross-bar, which sleeves serve to support the pivots of two steering wheels, each of which is capable of turning round its pivot point sufficiently to enable its axis to cross the rear axle. On the upper end of the right-hand sleeve is a horizontal tube supporting the steering hand wheel, whilst on the lower extremity of each pivot is a steel bracket, to which is hinged the bracket of the axle of the corresponding wheel, the free ends of the latter bracket being coupled through two connected springs to the end of the former bracket. The same arrangement is applied to the other steering wheel, and enables springs to be employed without necessitating the use of an oscillating axle, with the springs placed transversely to the vehicle.

Wheel Versus Lever.

A matter which at times has excited considerable interest is whether it is better to operate the steering gear with a lever or wheel. The obvious advantage gained by employing an arrangement of worm and worm wheel, bevel or miter wheels, or other train of toothed gearing, is that the wheels are held firmly to any position to which they may be adjusted, and will therefore strike against, and surmount, any obstacle with which they may come into contact on the road surface, without being shifted from such position, and without imparting any disagreeable jar or jerk to the driver or person who controls the steering.

It is hardly correct when the author of the above draws a distinction between lever steering and wheel steering, assuming that reaction from the inequalities in the road upon the steering mechanism is more liable to take place when a lever is used than when the lever takes the form of a hand-wheel. Whether the reaction will take place or not depends solely upon the intermediate mechanism between the lever or wheel at the top and the front axle pivot below. This may be

designed to work only one way—by worm gear or any other suitable arrangement—whether an ordinary lever is used or a wheel, which latter is only a continuous lever.

Tires and Lateral Shocks.

Of resilient tires the pneumatic is the one which gives the best results. Instead of the entire weight of the vehicle having to be raised over any intervening obstruction, or crushing it into the roadway, or when passing over a soft surface the wheel sinking in such a manner that it must either crush down or surmount the incline in front of it, the pneumatic tire, on the contrary, absorbs or swallows up, so to say, either entirely or partially, the obstruction, and thus obviates the necessity for the lifting of the wheel and vehicle, or at any rate greatly reduces the height through which such lifting action must take place. Not only is an obstacle more easily surmounted in this manner, but, furthermore, the tire obtains a better grip. The striking of any obstacle which may be situated on the one or the other side of the actual contact point on the wheel base is also to a large extent taken up by the cushioning action of a pneumatic tire, and the pressure exerted through the spokes greatly reduced in consequence of this reduction in side thrusts. In the case of the steering wheels this is an advantage of great value, inasmuch as it enables them to be maneuvered with a greatly reduced expenditure of energy, and renders their operation a far easier matter.

It seems, therefore, that for the lighter class of vehicle, and especially those fitted with pneumatic tires, lever steering is the most suitable, as being the quickest in action and the simplest. But, for the heavier vehicles, and those which are not fitted with resilient tires, wheel steering gear is practically a necessity.

The desirability of a steering mechanism which will not be caused to vibrate

by the roughness of the road, is probably even more desirable than the English author intimates, and his conclusion to the effect that lever steering—by which he erroneously understands a direct connection allowing transmission of power both ways—is preferable for light vehicles for being quickest in action and simplest, can hardly be accepted. He confounds two things which are being daily confounded also in this country, in taking for granted that steering mechanism which may be called sensitive because a small movement of the conductor's hand causes a relatively large change in the course of the vehicle, cannot be locked in any position given it. Sensitiveness of the steering gear is one thing. Locking it against reaction from the road is another. They may be combined if desired. Also, the non-sensitive gear, that the author identifies with hand-wheel steering, does not necessarily give a one-way transmission, and when it does not some of its advantages are lost.

One-Way Transmission Gears.

One-way transmission gear for the steering mechanism is probably always preferable, but it is especially preferable when the steering is sensitive, because in that case the driver finds it an intolerable strain to be always ready to resist with his hand the small movements of the steering lever (or wheel) which may be unexpectedly transmitted from the road at any time. Probably all the lever steering mechanisms in use in United States are more sensitive than they should be.

ALUMINUM IN CARRIAGE WORK

PRACTICAL HINTS UPON THE USEFULNESS AND LIMITATIONS OF THE LIGHT METAL FOR DIMINISHING THE WEIGHT OF MOTOR VEHICLES WITHOUT SACRIFICE OF STRENGTH.

For the past two years the employment of aluminum, to reduce the weight of motor vehicles without sacrifice of strength, has been rapidly increasing and in many instances in the French industry good results have been obtained.

Its advantages are self-evident in the many cases where tubular steel construc-

tion is unavailable from the nature of the strains or impacts to which the parts might be exposed, and where solid steel would be either unnecessarily heavy or—if of smaller dimensions—not rigid enough.

In a paper read before the Institute of British Carriage Builders some of the

points to be considered in the use of aluminum were set forth substantially as follows:

Only Recently Become Available.

"It is only during the last three or four years that aluminum has been commercially available in the practically pure condition of ninety-eight and a half per cent of the metal, which has made a great stimulus in its use, its capacity for resisting corrosion being very much greater in the purer state, whilst its electrical conductivity has increased from twenty to thirty per cent. Weight for weight, this is very nearly double the conductivity of copper—an important point to bear in mind in constructing electrical carriages, in which copper conductors form quite a considerable part of the total weight. Aluminum is extremely ductile, and one of the easiest metals to work under the rolls; in fact, rolled sheet one-thousandth of an inch in thickness is much used for beating into leaf for purposes of decoration, silver leaf having been entirely driven out of the market, as the former metal has the advantage of not getting tarnished. Sheet metal can be bent cold, and treated generally in the way brass and copper are. For panellings this sheet metal will be found invaluable, especially so where single sweeps are concerned. In the case of double sweeps or dome shapes, such as are required for the roofs of broughams and hansoms, it will be found that those accustomed to this class of work will find little difficulty in hammering the sheet into the desired form, though this process must always take more time, and be, therefore, more expensive than dealing with single curves. Of course, if a great deal of similar work has to be turned out the cheapest way would be to stamp the curves in the sheets with steel dies, which would be a considerably cheaper process than that of shaping and working up curves on built-up material intended for a roof or other curved part.

Riveting and Burnishing.

"In order to give sufficient rigidity to panels made in such a way cross-ribs, supports, or shaped bearers must be provided at intervals, against which the

curved sheet will bear, and these bearers may well be of cast aluminum of slight section, having ends bolted to an aluminum or wooden framework. Sheet aluminum panels may be fixed either to a frame cast of the same metal, or one of wood. In the former case, a very secure method of fixing the panel is by rivets; it must be borne in mind, however, in riveting aluminum sheets, that the metal is so malleable as to have a tendency to elongate if the rivets are close to the seam. The rivets should, consequently, be slightly smaller than the holes.

"Another method of dealing with panels which is coming into vogue is to stamp or hammer the panel in such a way that a bead or frame is formed along the sides from the sheet itself. By carefully burnishing this bead or frame and painting the panel a most pleasing effect is produced. It may be useful to note here that the favorite method of burnishing aluminum is to employ the ordinary blood-stone or steel burnisher, which must be dipped in a mixture of equal weight of olive oil and rum, shaken together in a bottle until an emulsified consistency results; the treatment is then similar to that for burnishing silver, care being taken not to press as hard as would be the case with the latter metal.

Method of "Frosting."

"The Americans obtain a most brilliant finish by simply using a piece of soft wood soaked in olive oil, with which the grain of the metal is filled up. Great saving is effected in using aluminum sheet for the panels and roofs of such vehicles as broughams or hansoms, in that there is no necessity for any hide to be pasted on. A very slight amount of 'filling-up' is required before painting, while only half the usual number of coats of paint will be needed. The sheet metal, if properly prepared by 'frosting,' will be found to take and adhere to the paint in a most satisfactory manner. This essential 'frosting' is carried out in the following way? The sheet to be treated is dipped for fifteen to twenty seconds in a hot bath prepared by taking ten per cent of caustic soda, diluting it with cold water, and saturating with about two and a half per cent of common salt in an iron

vessel. The solution must be heated, but not boiled. The surface of the sheet, which will have become nearly black, and covered with air bubbles, must be washed in an abundance of cold water by the aid of a fiber brush, then again dipped and washed, and finally placed in an earthenware vessel, containing concentrated nitric acid, until the metal has become quite white; after this, washing in cold, running water, and drying in warm, fine sawdust, will complete the process. If this dipping is carried further, a very pleasing matt is given to the surface, which will keep indefinitely.

Welding and Soldering.

"In building up the framework of carriages, aluminum may be used with advantage, either in castings or in the rolled state, in channel, T, or other suitable sections, having a strength of from sixteen to twenty tons per square inch, the various parts being bolted together, care being taken that where metal joins metal, a piece of leather or equivalent material is interposed between the two to absorb vibration. Where an electrical plant is available, a most effective method of joining parts is by electrically welding them, a comparatively easy process with aluminum if due precaution is taken.

"Greater use will undoubtedly be made in the future of soldering for joining aluminum parts together and to other metals. At present, however, though hard and soft solders are both available, great care must be exercised on the part of the manipulator in effecting a thorough job. The difficulty to contend against is that, immediately on exposure to air, a

slight film of oxide forms over the surface of the metal, which, though arresting any further corrosion, at the same time entirely prevents the aluminum being, so to say, 'tinned.' It is essential, therefore, to expose a fresh surface of metal only when covered by the molten solder. Among others, the British Aluminum Co., Ltd., to whom I am indebted for having kindly assisted me in obtaining data for this paper, have a special solder for this purpose. Their instructions are to clean off all dirt and grease from the surface of the metal with a little benzine, apply the solder with a copper bit, and, when the molten solder is covering the surface of the metal, scratch through the solder with a little wire scratch brush. By this means the oxide on the surface of the metal underneath the solder is broken up, and the solder, containing its own flux, takes up the oxide, and enables the surface of the aluminum to be 'tinned.'

"The bodies of motor carriages have frequently to withstand very considerable strains, and, in order that their appearance may not be prejudiced by the provision of the necessary strength, the metal tubes or girders are so intermingled with the body as to form part of the lines of same. Aluminum has been used under these conditions with considerable success; its low specific gravity (2.6 rolled) is of immense importance where self-propelled vehicles are concerned."

It is as true about automobiles as about bicycle tires, that "they are all good until something is the matter with them."

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